This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

Pacific and Atlantic railroad company.

Report of the chief engineer ... William J. Lewis. 1851.

STANFORD UNIVERSITY LIBRARY

Gift of
J. C. L. Fish

Original copy typewritten
in capital letters
Thirty-four pages

Stanford Library Call No.
~~V~~
~~385.08~~
~~P 116~~

THE

REPORT

OF THE CHIEF ENGINEER OF THE

PACIFIC AND ATLANTIC RAIL ROAD COMPANY.

WILLIAM J. LEWIS, CHIEF ENGINEER

C47704

1851

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

467745

[illegible]

REPORT OF THE CHIEF ENGINEER

To the President and Directors of the Pacific and Atlantic Rail Road Company:

Gentlemen:- In compliance with your instructions, the engineer department was organized, and the preliminary surveys for a rail road connecting the cities of San Jose and San Francisco were commenced on the 18th of September last. Since that date, the intervening ground has been thoroughly examined, and a line of location established.

It will be proper, before noticing the surveys, to give a brief topographical description of the country traversed by the road. The City of San Jose is situated 13 miles south of the head of San Francisco Bay, near the middle of the beautiful and fertile valley of Santa Clara, which has at this point a width of about 18 miles.

The general course of this valley is nearly parallel to the Pacific Coast, from which it is separated by the Santa Cruz mountains, while another range (the Contra Costa mountains) forms its north-eastern boundary, and divides it from the valley of San Joaquin. The last named range terminates to the north, at the Straits of Carquines; and Mount Diablo is its highest peak.

The Santa Cruz range extends north-westerly to the Pacific Ocean, which it strikes about seven miles south-west of the Golden Gate.

Between these ranges lie the valley of Santa Clara, the bays of San Francisco and San Pablo, and the city of San Francisco.

On the western side of the bay, eight miles south of San Francisco, is an elevated peak called Mount San Bruno, which forms the north-western terminus of the valley land on the side of the Santa Clara valley. Several high and long spurs extend from this mountain northward to the Pacific Ocean, and eastward to the Bay. and give to the promontory on which the city of San Francisco is situated, its rugged and mountainous character.

The southern arm of the Bay terminates about 30 miles south of San Francisco, and from San Bruno to its head is encompassed by marsh land, overflowed by the tides.

Between the base of the mountains and the wet lands, there is, on both sides of the Bay, an interval of valley land, sloping gently to the Bay, and gradually increasing in width and decreasing in inclination as we advance southwardly, until at the head of the Bay it forms a continuous plain from mountain to mountain.

The plain near the mountain is composed of [illegible] incapable of retaining water, but the lower lands are [illegible] character.

REPORT OF THE CHIEF ENGINEER.

To the President and Directors of the Pacific and Atlantic Rail Road Company:

Gentlemen:- In compliance with your instructions the engineer department was organized, and the preliminary surveys for a rail road connecting the cities of San Jose and San Francisco were commenced on the 15th of September last. Since that date, the intervening ground has been thoroughly examined, and a line of location established.

It will be proper, before noticing the surveys, to give a brief topographical description of the country traversed by the road. The City of San Jose is situated 12 miles south of the head of San Francisco Bay, near the middle of the beautiful and fertile valley of Santa Clara, which has at this point a width of about 15 miles.

The general course of this valley is nearly parallel to the Pacific Coast, from which it is separated by the Santa Cruz mountains, while another range (the Contra Costa mountains) forms its north-eastern boundary, and divides it from the valley of San Joaquin. The last named range terminates to the north, at the Straits of Carquinez; and Mount Diablo is its highest peak.

The Santa Cruz range extends north-westerly to the Pacific Ocean, which it strikes about seven miles south-west of the Golden Gate.

Between these ranges lie the valley of Santa Clara, the bays of San Francisco and San Pablo, [illegible] Francisco.

On the western side of the bay, eight miles south of San Francisco, is an elevated point called Point San Bruno, which forms the north-western [illegible] of the valley [illegible] Santa Clara valley. Several [illegible] extend [illegible] mountain northward [illegible] Pacific Ocean, [illegible] and give to the promontory on which the city of San Francisco is situated, its [illegible]

The southern [illegible] of the bay [illegible] south of San Francisco, and from San Bruno [illegible] by marsh land, overflowed by the tides.

Between the base of the mountains and [illegible] is, on both sides of the bay, an alluvial [illegible] level land, sloping gently to the bay, [illegible] gradually increasing in [illegible] in inclination [illegible] by it form [illegible]

[illegible]

incapable of [illegible] plains character.

The streams which issue from the mountains sink in the higher parts of the valley, and re-appear on the low lands, and form springs and marshes. During the rainy season, the accumulated waters from the mountains rush through deep channels cut in the gravelly soil, and spread themselves over the alluvial lands below.

Annually the winter torrent sweeps with it a body of sand which is deposited on the plain. When this sand has accumulated sufficiently, a dam is formed, which is broken by a subsequent action of the water; more sand is carried down and similarly deposited, and thus gradually on each side of the bed of the stream a bank is raised above the natural surface in its vicinity. By referring to the accompanying profile, it will be seen that this curious feature characterizes most of the arroyos crossed by the located line.

In the selection of a proper route for a rail road, it has been my endeavor, having due reference to grades and directions, to place the line as far as practicable on the higher slope of gravel land.

With these remarks, I shall proceed to the

PRELIMINARY SURVEYS.

An experimental line was run, commencing at Peter Davidson's lot, on the south side of Santa Clara Street, in the City of San Jose. A direction parallel to Santa Clara Street was assumed and continued across the Guadaloupe River and the low lands on the western side of the stream. The line then curved to the right on a radius of 3820 feet for seven-tenths of a mile, and was continued in a tangential direction 10 3/4 miles to a point south of Mariano Castro's house. The line then curved to the right on a radius of 5730 feet for 1500 feet, and from the termination of this course a straight line was run to a point (marked A on the map) near Angelo's.

The route above described passed a short distance south of the town of Santa Clara, but between Santa Clara and San Jose it crossed a considerable extent of land subject to be overflowed in the rainy season, which would be avoided by a more southern line.

It was also found that at Campbell's Creek, the Arroyo Cupertino, the Arroyo de Las Yeguas, and the Embarcadero of the Rancho de Las Pulgas, an improved line could be obtained by keeping further from the Bay. A new position (B) 761 feet south-west of A was therefore assumed, and the survey continued across the San Mateo, and over the land of Jose de la Cruz Sanchez as far as the French Tavern, near the base of Mount San Bruno. Here two routes diverging at the point marked C on the map presented themselves for examination. One, passing between the mountain and the Santa Cruz range, and crossing a spur of the San Bruno at the gap near the Abbey Hotel, enters the valley of Islar's Creek. The other passes

between the Bay and Mount San Bruno, and crosses the spurs of the mountain which intervene between this mountain and San Francisco.

The western line first received our attention, and a survey was made across the Abbey summit and continued to the Mission Dolores. The summit near the Abbey has an elevation of 229 5/10 feet high tide. The level of the ground at the Nightingale Hotel in the Mission Dolores, which may be assumed as the general level of the plain, is 34 feet above high tide--neither is practicable to construct a rail road, the grade of which at the Mission shall differ materially from this level. The distance from the Abbey summit to this point is 4.73 miles. Hence, assuming a depth of cut of 38.5 at the Abbey summit, a grade of 48 feet to the mile is required to reach the Mission. In addition to the serious disadvantage of using so high a grade, this line presents, in many parts, an exceedingly irregular profile. At the summit of the ridge dividing Islar and Precito Creeks (south of the race course) a depth of cutting of 104.5 feet would be necessary in order to maintain this grade.

It will be observed that both Islar and Precito Creeks flow into the tide marsh west of Capt. de Frees' house, and that the dividing ridge terminates abruptly to the east at the head of the marsh. An attempt was made to pass around the ridge in this direction, but the ground was so broken, it was found impracticable.

The preliminary examinations on the Bay line, fully demonstrated its great superiority over this route.

Returning to the position C, near the French Tavern, the survey was extended to a point (D) on the shore of the Bay, near San Bruno. Here the line of location evidently required that it should cross an angle of the Bay. Also an inspection of the ground showed that an accurate survey of the shores of the Bay, from this position to near Hunters Point, was necessary, to determine the proper location of the line. This was accordingly made, and the whole accurately plotted. The results of these examinations showed that it was requisite that the line of location should pass from Point San Bruno, which shuts in Visitation Valley on its northern side.

A proper position (E) was assumed beyond this point, and surveys carried across two depressions in the spur which forms Hunters Point, or South San Francisco. The most eastern depression (marked E on the map) is 85 feet, and the western (marked F) 69 feet above tide.

The last named position, in addition to the advantage of its lower level, enables us to continue the line beyond this point on the sidehill at the head of the marsh, north of Capt. de Frees', thus avoiding all the marsh land except 800 feet at the mouth of Islar and Precito Creeks.

Following this side-hill, the surveys were conducted to a point (G) a short distance east of the race course. From this point to Third Street in San Francisco, two lines were examined

are hardly perceptible to the casual observer.

From Angelo's to San Mateo there is but a narrow valley between the base of the hills and the Bay, and beyond San Mateo many of the spurs extend to the Bay.

From San Mateo the line is traced along the side hill deflecting to the left as we approach the residence of Chino Sanchez and again to the right near the house of Jose de la Cruz Sanchez. At the French Tavern it curves to the right, and crossing a stretch of low land, pierces a sandy ridge and attains the shores of the Bay near Point San Bruno.

The line now curves around the rocky point of San Bruno and is located in a straight direction to the extremity of the bluff forming the northern boundary of Visitation Valley.

Here it is designed to construct a pile bridge 13,000 feet in length.

The character of the bottom of the Bay was ascertained by careful soundings at a number of points in the located line.

The average depth of water at high tide is 10 feet, and the average depth of mud 23 feet. There is great uniformity in the depth of water and character of the bottom, and there is everywhere sufficient depth of mud to give adequate stability to the piles.

The bridge is estimated for piles 45 feet in length (6 being driven in each bent) and the bents are placed 10 feet apart. The piles are then capped and braced, and the bents connected by 4 longitudinal stringers, two 8 by 14, and two 10 by 14 inches, the latter designed to be directly under the rails of the track. The bridge, which is 15 feet in width, is covered with three-inch plank, on which the iron rails are laid.

I have stated particularly the mode in which it is proposed to build this part of the work, as its cost forms the largest item in the expense of constructing your road.

It is designed to fill up the space between the shores and the end of the pile bridge with solid embankment.

From the northern end of the pile bridge the line curves to the left, and passing the rocky point leaves the Bay and crosses the South San Francisco ridge at the point already indicated, 69 feet above tide water.

At this summit we have estimated a depth of cutting of 33 feet, which places the grade line at 36 feet above tide.

The line then crosses Islar's Creek and is conducted along the slope of the high ground at the head of the marsh three-fourths of a mile above Captain de Frees' house. Thence, crossing Precito Creek and passing east of the race course, it curves to the right, and assuming a straight direction near the brick kiln crosses Mission are hardly perceptible to the casual observer.

From Angelo's to [illegible] there is but a narrow valley between the base of the hills and the bay, [illegible] many of the [illegible] extend to the bay.

From [illegible] the line is [illegible] along the side hill deflecting to the left as we approach the residence of Chino Sanchez and again to the right near the house of Jose de la Cruz Sanchez. At the French ravine it curves to the right, and crossing a stretch of low land, [illegible] a sandy ridge and skirting the shores of the bay near Point San Bruno.

The line now curves around the rocky point of San Bruno and is located in a straight direction to the extremity of the point forming the northern boundary of Visitacion Valley.

Here it is proposed to construct a pile bridge 12,000 feet in length.

The character of the bottom of the bay was ascertained by certain soundings at a number of points in the [illegible] line.

The average depth of water at high tide is 15 feet, and the average depth of mud [illegible] feet. There is great uniformity in the depth of water and character of the bottom, and there is everywhere sufficient depth of mud to give [illegible] stability to the piles.

The bridge is estimated for piles 45 feet in length (to be driven [illegible]) [illegible] the bents are placed 15 feet apart. The piles are then capped and braced, and the bents connected by 4 longitudinal stringers, two [illegible] 14, and [illegible] 16 inches, the latter designed to be directly under the rails of the track. The [illegible], which is 12 feet [illegible], is covered with [illegible]-inch [illegible].

I have [illegible] to the [illegible] it is proposed to [illegible] this part of the [illegible], [illegible] item in the expense of [illegible].

It is [illegible] the [illegible] [illegible].

From the [illegible] to the left, and [illegible] the rocky point leaves [illegible] the point [illegible] feet above tide water.

As [illegible], which [illegible] the [illegible] line [illegible] feet above tide.

[illegible] of the [illegible] crosses [illegible] Street [illegible] of the two courses, it curves to the right, and [illegible] in direction near the brick kiln crosses [illegible].

Creek on a bridge 150 feet in length and enters the city of San Francisco. This line was continued in the same direction to Third Street, which it intersected between Howard and Mission Streets.

From this point, where the survey terminates, the line can be conducted to the wharves of the Bay, without encountering any difficulties as regards curvature of grades.

The height of the grade line at Third Street is 15 feet above high tide.

The whole length of the road from Market Street, San Jose, to Third Street, San Francisco, is 48.04 miles.

Of this distance there are

of straight lines	42.07	miles
of curves having a radius of 8,595 feet	1.14	"
" " " " " 7,473 "	0.64	"
" " " " " 5,730 "	1.95	"
" " " " " 2,865 "	2.24	"
	48.04	miles

There are

of level road	15.78	miles
of gradients under 5 feet to the mile	2.06	"
" " over 5 feet and not exceeding 10 ft.	4.83	"
" " " 10 " " " " 15 "	8.73	"
" " " 15 " " " " 20 "	9.77	"
" " " 20 " " " " 21.6 "	6.87	"
	48.04	miles

The graduation has been estimated for a road bed 16 feet in width on embankments, and 20 feet in excavations, the sides having a slope of 1 1/2 feet horizontal to 1 foot perpendicular. On the first division, from San Jose to San Mateo Creek, six-sevenths of the earth work consists of borrowed earth and spoil bank; or, in other words, the road bed is made by forming the embankments from the side ditches, and by removing the earth in the cuts and depositing it on the adjacent banks--neither process requiring the employment of horses and carts. There are no deep cuttings above (or south-east) of Point San Bruno, and no rock will be encountered. Between San Bruno and Mission Creek, there is rock in all the spurs and ridges crossed by the line location.

The present cost of rail road iron in Liverpool is £5 per ton, and freight from that port to San Francisco from £2 10s to £3 per ton. The duty, which is 30 per cent, is charged on the prime cost--commissions and all charges arising at the port of embarkation. It will be seen that the price estimated, $50, allows a considerable margin on these rates, and is sufficient beyond a doubt, should rails in Europe continue at the present very low figure.

It will be the policy of the company to commence laying the superstructure at points in the vicinity of landings accessible by vessels navigating the Bay. Launches freighted with iron can unload at the head of Mission Creek, at the Embarcadero on the Sanchez Rancho, at San Mateo Creek, at the Embarcadero of the "Rancho de las Pulgas" south of Angelo's, and at the landing on San Francisquito Creek; all of which are in immediate proximity to the road. From the two latter points, the Santa Cruz mountains, where an abundance of red-wood timber can be procured, are not more than five miles distant This wood is less subject to decay than any known in the Atlantic states, and no better material for cross ties can be desired.

TABLE OF GRADES ON THE PACIFIC AND ATLANTIC RAIL ROAD

No. of Grades	Length of Grade in Miles	Grade Per Mile in Feet	Rise of Grade in Feet	Fall of Grade in Feet	Elevation Above High Tide in Feet
1	.57	level			96
2	1.03	17.6	18		114
3	1.03	level			114
4	1.36	8.8		12	102
5	.97	10.5		10.2	91.8
6	.45	level			91.8
7	.97	1.75	1.7		93.5
8	2.84	12.8	36.5		130
9	.62	8.8	5.5		135.5
10	.91	11.4		10.4	125.1
11	3.30	20.6		68.1	57
12	1.47	15.8		23.4	33.6
13	.40	level			33.6
14	2.04	20	41.4		75
15	1.14	7.75		8.8	66.2
16	2.10	21.6		45.5	20.7
17	.74	15.8		11.7	9
18	1.09	2.8	3		12
19	1.76	level			12
20	.91	19.8	18		30
21	.91	16		15	15
22	1.36	level			15
23	.74	9.5	7		22
24	.97	12	12		34
25	.91	17.6	16		50
26	.97	18		18	32
27	1.53	11		17	15
28	2.59	level			15
29	.97	5.28	5		20
30	.79	19		15	5
31	5.12	level			5
32	1.47	21.2	31		36
33	1.93	level			36
34	1.51	14		21	15
35	.57	level			15
	48.04				

Length of Level in Miles	SUMMARY Length of Gradients in Miles From 0 to 5 ft.	 From 5 to 10 ft.	 From 10 to 15 ft.	 From 15 to 21.6 ft
15.78	2.06	4.83	8.73	16.64

STATEMENT OF LENGTH OF STRAIGHT LINES AND CURVES

No.	Straight Line Miles	Radius 8995 Feet Miles	Radius 7473 Feet Miles	Radius 5730 Feet Miles	Radius 2865 Feet Miles
1	0.86				
2				1.04	
3	8.79				
4				0.16	
5	2.71				
6				0.15	
7	6.61				
8				0.06	
9	10.05				
10				0.18	
11	2.56				
12				0.36	
13	2.08				
14		1.14			
15			0.64		
16	2.21				
17					0.24
18	2.37				
19					0.45
20	1.48				
21					0.63
22	0.22				
23					0.45
24	0.78				
25					0.47
26	1.35				
	42.07	1.14	0.64	1.95	2.24

ESTIMATES

ESTIMATE OF COST OF GRADUATION, MASONRY AND BRIDGING

First Division

From San Jose to San Mateo Creek 29.66 miles	
255,960 cu. yd. earth work, 30 cents	$76,788.00
43,561 " " " " , 42 "	18,295.62
765 " " bridge masonry $10	7,650.00
Superstructure of bridges	12,100.00
Grubbing and clearing	6,000.00
	$120,833.62

Second Division

From San Mateo Creek to the beginning of the Pile Bridge at Point San Bruno, 10.1 miles:

119,094 cu. yd. earth work, 30 cents	$35,728.20
42,754 " " " " 36 "	15,391.44
56,231 " " " " 60 "	33,738.60
2,675 " " bridge masonry, $9	24,075.00
Superstructure of bridges	8,000.00
	$116,933.24

Third Division

Includes the proposed pile bridge across the indentation of San Francisco Bay, north of Point San Bruno, 2.52 miles.

13,300 feet of pile bridging, at $25	$332,500.00

Fourth Division

From the north end of the pile bridge to the race course, 3.47 miles

214,371 cu. yd. earth work, 40 cents	$85,748.40
50,457 " " rock, $3	151,371.00
706 " " arch masonry, $10	7,060.00
	$244,179.40

Fifth Division

From the race course to Third Street, San Francisco, 2.28 miles.

78,533 cu. yd. earth work, 40 cents	$ 31,421.20
6,147 " " rock, $3	18,441.00
921 " " masonry (abutments to bridge over Mission Creek), $9	8,289.00
Superstructure of bridge over Mission Creek, 150 feet, at $40	6,000.00
	$ 64,151.20

Summary of Cost of Graduation, Masonry and Bridging

First Division,	29.66	miles	$120,833.62
Second "	10.10	"	116,933.24
Third "	2.52	"	332,500.00
Fourth "	3.48	"	244,179.40
Fifth "	2.28	"	64,151.20
			$878,597.46

Estimated Cost of One Mile of Superstructure

88 tons of rails (56 lb. per yard) at $50	$ 4,400.00
660 chairs, 16 lb. each - 10,560 lb. - at 6 cts.	633.60
4,000 lb. spikes, at 6 cts.	240.00
2,000 sleepers, 7½ ft. long, 6 by 7 in. at 60 cts.	1,200.00
Laying track and distributing material	1,000.00
Total for one mile	$ 7,473.60

Cost of 51 miles of superstructure (including 3 miles for side tracks, and extension of the road to the wharves of San Francisco) at $4,473.60	$381,153.60
Graduation, masonry, and bridging	878,597.46
	$1259,751.06
Add for Superintendence, 10 per cent	125,975.11
Total cost of constructing the road	$1385,726.17

Buildings and Fixtures

Two depots, at $10,000 each	$ 20,000.00
Six way stations, $500 each	3,000.00
Two engine houses, $5,000 each	10,000.00
One machine shop	10,000.00
Two turning tables, $3,000 each	6,000.00
Total	$ 49,000.00

Locomotives, Cars, etc.

Five locomotive engines and tenders, $9,000	$ 45,000.00
Ten passenger cars, $3,000	30,000.00
Four baggage cars, $1000	4,000.00
Six platform cars, $800	4,800.00
Twenty covered freight cars, $1,000	20,000.00
Six hand freight cars, $100	600.00
Total	$ 104,400.00

The total cost of the rail road, buildings and running fixtures will consequently be as follows:

Construction of road	$1,385,726.17
Buildings and fixtures	49,000.00
Running Furniture	104,400.00
Total	$1,539,126.17

It will be observed that the rail road does not leave the valley until it reaches Mount San Bruno, which is but 8 1/4 miles from San Francisco, and that all the expensive part of the graduation occurs on the six miles embraced in the Third and Fourth Divisions. The graduation of the First and Second Divisions, including five-sixths of the whole length of the road, could be completed, the superstructure laid, and the road put in operation as far as Point San Bruno, within a year.

At the northern termination of the Second Division, where it is designed to commence the pile bridge, there is 5 feet of water at low tide and ten feet at high tide, and there are no

obstructions to navigation between this point and San Francisco. By placing a good steamboat on the Bay, to ply between Point San Bruno and San Francisco and connect with the rail road; passengers to be conveyed from city to city in 2½ hours, and freight in 4 hours.

Vessels could also come to the wharves at Point San Bruno and receive cargoes of agricultural produce destined for Stockton, Sacramento and the mining sections of the state.

The following is an estimate of the amount required for building the road from San Jose to Point San Bruno:

Graduation, masonry and bridging 39.76 miles (First and Second Divisions)	$237,766.86
Superstructure 41 miles (including 1.24 miles of side track) at $7473.60	306,417.60
	$544,184.46
Add for Superintendence, 10 per cent	54,418.44
Cost of road from San Jose to Point San Bruno	$598,602.90
To which add for	
Wharf at Point San Bruno	15,000.00
Buildings and fixtures	35,000.00
Locomotive engines, cars, etc.	90,000.00
Steamboat on the Bay	50,000.00
Total	$788,602.90

which is the whole amount required to put the road in operation from San Jose to San Bruno, and to complete the line of communication to San Francisco by steamboat.

It will thus be seen that many of the advantages to be derived from the construction of the rail road can be obtained at an outlay little above one-half the whole cost of constructing the road. We have no doubt that it will be the true interest of the stockholders to complete the line at as early a day as is practicable throughout its whole extent, and the object of the preceding remarks has merely been to show that you may safely commence the construction of your work when the subscription to the stock amounts to $790,000.

SOURCES OF REVENUE

We shall now endeavor to ascertain what will be the probable amount of business on your road. In an address of the committee appointed at a public meeting of the citizens of San Jose in relation to the feasibility and expediency of a rail road between San Jose and San Francisco, adopted January 29, 1851, they say:

"During the last seven months the amount of passenger travel between this place and San Francisco has not been less than 10,500, at an average expense of $16 each, making a total of $168,000. During the same time, about 2,000,000 feet of lumber were brought to the Embarcadero at an average cost of $15 per thousand feet, amounting to $30,000; to this must be added $30,000 for other freight. In this enumeration we omit the immense quantities of hay, wood, brick, potatoes, quicksilver, cattle, and various other articles which have been transported to San Francisco by water or land. To this we must add the cost of carting to and from the Embarcadero. Some estimate may be formed of the enormous item of this expense by the fact that one firm, and that not one of the largest, has paid during six months over $3,000.

"These facts justify the supposition that the expense of transportation for the six months ending December 31, 1850, has not been less than $300,000, or more than one-sixth the entire receipts of all the rail roads in Massachusetts.

"The history of rail roads has established the fact that in a short time they greatly increase the amount of freight and travel, particularly the latter. Our wisest rail road directors abroad lay it down as a rule that any route will sustain a rail road when the expense of grading comes within reasonable limits, and that sustains a daily stage, because the increased facilities for traveling afforded by a rail road invariably increase the number of travelers. When merchants living sixty or one hundred miles from the city can enter the cars in the morning, make their purchases, and return the same day, their visits increase more than ten-fold."

Since this address was written, another season has passed away, in which the amount of passenger traveling has been more than doubled, and the aggregateof freight has also greatly increased. There are now three lines of communication between San Jose and San Francisco--one daily, by Messrs. Hall & Crandal's splendid line of coaches, and two tri-weekly, connecting with steamboats at Alviso and Union City. The daily average of through passengers each way cannot be less than 50 persons.

The president of the company has taken the pains to collect the following statistics:

Produce Shipped from Santa Clara Valley to
San Francisco the Past Season

Barley	3,292	tons
Potatoes	6,418	
Hay	10,700	
Fruit (chiefly from the Missions)	450	
Lime	1,200	
Tomatoes	169	
Cabbage	710	
Onions, beets, pumpkins, corn, turnips and melons	3,900	
	26,837	tons

San Francisco is barricaded by sand hills, from which we do not escape until we reach the Mission Dolores, and hither all the pleasure-seeking part of the population resort for relaxation and amusement. Here are the first gardens we meet with, and here also is the race course and the arena for the exhibition of the combats of bulls and bears. On Sunday and holidays the road is thronged with omnibuses, carriages, men on horse back, and pedestrians. The number of passengers carried to and from the Mission, by public conveyance alone, has been ascertained to be 4,000 a month, or at the rate of 48,000 per annum. When the means are provided by the construction of a rail road for easy and cheap access to the country, many merchants will undoubtedly secure residences for their families either at the Mission, or at more distant localities.

The mildness and salubrity of the climate of San Jose will make it a favorite abode for invalids, and for many whose business does not require their constant presence in San Francisco. From the Mission Dolores to the pass of the San Bruno mountain, near the Abbey Hotel, the public road passes over deep gulches, and from the pass to the foot of the mountain on the south side, it traverses sand hills for several miles. In a word, it is, and always must be, a bad road, and it would seldom be travelled were the railroad built.

The southern base of San Bruno is, by our line, less than nine miles from San Francisco, and above this point is a large body of land well adapted for grazing or culture. The difficulty of access to the market makes the land at present of little value. But the rail road will create and engross a considerable amount of travel and traffic at this point. As we proceed southward, the land improves in quality until we reach the head of the Bay.

The valley of Santa Clara extends from the southern extremity of the Bay of San Francisco, to the Mission of San Juan Bautista, a distance of fifty miles, and it embraces an area of not less than six hundred square miles. The land is probably not surpassed in fertility by any in the world, and all its products must become tributary to your road. The adjacent hills also abound in mineral wealth. Limestone is found in the low hills on both sides of the valley, and the large quantity of quicksilver sent from New Almaden will be greatly increased by the products of the Guadaloupe and San Antonio mines.

Having intimated some of the sources of revenue, we shall now present an estimate of the business of the company for the first year it is in operation.

Estimate of the Probable Receipts of the Pacific and Atlantic Rail Road Company, the First Year Subsequent to its Completion

Passengers

150 through passengers (75 each way) daily, or 54,750 per annum, at $5	$273,750.00
50 way passengers (25 each way) daily, from all the way stations except the Mission Dolores, or 18,250 per annum, at $2	36,500.00
70,000 to and from Mission Dolores, 50 cents	35,000.00

San Francisco is surrounded by sand hills, from which we do not escape until we reach the Mission Dolores, and hither all the pleasure-seeking part of the population resort for relaxation and amusement. Here are the first gardens we meet with, and here also is the race course and the arena for the exhibition of the combats of bulls and bears. On Sunday and holidays the road is thronged with omnibuses, carriages, men on horse back, and pedestrians. The number of passengers carried to and from the Mission, by public conveyance alone, has been ascertained to be 4,000 a month, or at the rate of 48,000 per annum. When the means are provided by the construction of a rail road for easy and cheap access to the country, many merchants will undoubtedly secure residences for their families either at the Mission, or at more distant localities.

The mildness and salubrity of the climate of San Jose will make it a favorite abode for invalids, and for many whose business does not require their constant presence in San Francisco. From the Mission Dolores to the pass of the San Bruno mountain, near the Abbey Hotel, the public road passes over deep gulches, and from the pass to the foot of the mountain on the south side, it traverses sand hills for several miles. In a word, it is, and always must be, a bad road, and it would seldom be travelled were the railroad built.

The southern base of San Bruno is, by our line, less than nine miles from San Francisco, and above this point is a large body of land well adapted for grazing or culture. The difficulty of access to the market makes the land at present of little value. But the rail road will create and engross a considerable amount of travel and traffic at this point. As we proceed southward, the land improves in quality until we reach the head of the Bay.

The valley of Santa Clara extends from the southern extremity of the Bay of San Francisco, to the Mission of San Juan Bautista, a distance of fifty miles, and it embraces an area of not less than six hundred square miles. The land is probably not surpassed in fertility by any in the world, and all its products must become tributary to your road. The adjacent hills also abound in mineral wealth. Limestone is found in the low hills on both sides of the valley, and the large quantity of quicksilver sent from New Almaden will be greatly increased by the products of the Guadalupe and San Antonio mines.

Having intimated some of the sources of revenue, we shall now present an estimate of the business of the company for the first year it is in operation.

Estimate of the Probable Receipts of the Pacific and Atlantic Rail Road Company, the First Year Subsequent to its Completion

Passengers

150 through passengers (75 each way) daily, or 54,750 per annum, at $5	$273,750.00
50 way passengers (25 each way) daily, from all the way stations except the Mission Dolores, or 18,250 per annum, at $2	36,500.00
70,000 to and from Mission Dolores, 50 cents	35,000.00

Total income from passengers	$345,250.00

Freight

Down freight, 40,000 tons at $5	$200,000.00
Up freight, 25,000 tons at $5	125,000.00
Total income from freight	$325,000.00
Total income from freight and passengers	$670,250.00

Expenses

Deduct expenses as follows:

Repairs of locomotives, passenger, baggage, and freight cars (equal to one-half their original cost)	$ 52,200.00
3,500 cords of wood, at $10	35,000.00
Oil	4,500.00
Salaries, wages, and incidental expenses chargeable to passenger department	30,000.00
Ditto to freight department	30,000.00
Repairs of road, and reserved fund for renewing and improving the same	50,000.00
Salaries of president, superintendent and treasurer, law expenses, etc.	50,000.00
	$251,700.00
Balance nett revenue	$418,550.00

or 27.19 per cent on $1,539,126.17, the cost of the road, fixtures, and equipment.

It is difficult to estimate the increase in passengers and freight which will be created by the construction of a rail road. The natural progress of population and business is so rapid in the United States that it is impossible to ascertain what proportion of the increased traffic which has followed the construction of rail roads was a direct consequence of that fact, and what was owing to extraneous causes. We trust, however, that we shall have no difficulty in showing that the estimate we have made of the receipts of the road during the first year of its operation is not too high, and that in a very short time the annual revenue must greatly exceed that amount. Baron Charles Dupin, in his "Report on the Paris and Orleans Railway," makes the following statements:

"Experience has proved, both in France and abroad, that in a short space of time the facility, expedition, and economy afforded by railways more than doubles the number of passengers, and the quantity of merchandise.

"In order to support such statements, we will quote the following facts relative to the railways of Belgium, England, Scotland, in positions of extreme difference, and giving rise to a variation in the returns which far exceeded all anticipation:

Comparison of the Number of Travelers Conveyed Daily Throughout a Whole or a Portion of the Line:

Railways	No. of Pass. Before the Establishment	No. of Pass. After the Establishment
Manchester & Liverpool	400	1,620
Stockton & Darlington	130	630
Newcastle & Carlisle	90	500
Arbroath & Forfar	20	200
Brussels & Antwerp	200	3,000

Increase of the Number of Passengers by the Establishment of a Railway

Liverpool & Manchester	300 per cent
Stockton & Darlington	380 " "
Newcastle & Carlisle	455 " "
Arbroath & Forfar	900 " "
Brussels & Antwerp	1,400 " "

"Thus, even taking as a criterion the road on which the proportional increase is least of all, we still find that the number of passengers will be not only 100, but 300 per cent. The transport of merchandise will experience a similarly rapid increase."

Edward Teisserence, an agent of the French Government, in an official communication in relation to English railways, says:

"The Darlington Railway has produced, by its low rate of passage and freight, a complete revolution in the region of country which it traverses. It has increased the value of land 100 or 200 per cent. By these low rates, the freight estimated at 80,000 tons has been increased to 640,000 tons. The passengers estimated at 4,000 have been increased to 200,000."

The following extract on the influence of railways in developing the resources of a country is taken from the second report of the Irish railway commissioners:

"On the Newcastle and Carlisle road, prior to the railway, the whole number of persons the public coaches were licensed to carry in a week were 343, or both ways, 686. Now, the average daily number of passengers by railway for the whole length, viz: 61.8 miles, is 228, or 1596 per week.

"The number of passengers on the Dundee and Newtyle line exceeds at this time 50,000 annually; the estimated number of persons who performed the same journey previous to the opening of the railway having been 4,000.

"Previous to the opening of a railway between Liverpool and Manchester, there were about 400 passengers per day, or 146,000 per year, traveling between these places by coaches, whereas the present number by railway alone exceeds 500,000.

Comparison of the Number of Travelers Conveyed Daily Throughout the whole or a portion of the Line:

Railways	No. of Pass. Before the Establishment	No. of Pass. After the Establishment
Manchester & Liverpool	400	1,580
Stockton & Darlington	130	630
Newcastle & Carlisle	50	300
Arbroath & Forfar	20	300
Brussels & Antwerp	200	3,000

Increase of the Number of Passengers by the Establishment of a Railway

Liverpool & Manchester	300 per cent
Stockton & Darlington	380 " "
Newcastle & Carlisle	455 " "
Arbroath & Forfar	500 " "
Brussels & Antwerp	1,400 " "

"Thus, even taking as a criterion the road on which the proportional increase is least of all, we still find that the number of passengers will be not only 100, but 300 per cent. The transport of merchandise will experience a similarly rapid increase."

Edward Teisserence, an agent of the French Government, in an official communication in relation to English railways, says:

"The Darlington Railway has produced, by its low rate of passage and freight, a complete revolution in the region of country which it traverses. It has increased the value of land 100 or 150 per cent. By these low rates, the freight estimated at 6,000 tons has been increased to 640,000 tons. The passengers estimated at 4,000 have been increased to 500,000."

The following extract on the influence of railways in developing the resources of a country is taken from the second report of the Irish railway commissioners:

"On the Newcastle and Carlisle road, prior to the railway, the whole number of persons the public coaches were licensed to carry in a week were 266, or [illegible] [illegible]; the average [illegible] number of passengers by railway for the whole length, viz: 61 miles, is 226, or 1253 per week.

"The number of passengers on the Dundee [illegible] line exceeds at this time [illegible] annually; the estimated number of persons who performed the same journey previous to the opening of the railway having been 4,000.

"Previous to the opening of the railway between Liverpool and Manchester, there were about 400 passengers per day, or [illegible] per year, traveling between these places by coaches, whereas the present number by railway alone exceeds 500,000.

"In foreign countries the results arising from the same cause, are equally, if not more striking. The number of persons who usually passed between Brussels and Antwerp were 75,000 in the year; but since the rail road has been opened from the former place to Malines, it has increased to 500,000; and since it was carried through to Antwerp, the number has exceeded a million. The opening of a branch from Malines to Termonde appears to have added 200,000 to the latter number, so that the passenger traffic of that rail road superceding a road traffic of only 75,000 persons now amounts to 1,200,000."

The following tabular statement of several rail roads in Massachusetts shows the estimated number of passengers before these ra roads were built, and the number transported upon them during the year 1848:

Name of Road	Estimated No. of Pass. Before Opened	No. of Passengers Carried in 1848
Boston and Worcester	23,500	807,143
Boston and Lowell	37,400	525,764
Fitchburg	71,790	745,825
Boston and Maine		1,021,169
Boston and Providence		569,127
Fall River		241,107
		4,967,704

The preceeding statement not only exhibits the wonderful increase in the amount of traveling on the four roads first mentioned, since these works were constructed, but it also shows that the aggregate number of passengers conveyed annually on the seven rail roads, which diverge from Boston, amounts to nearly five millions of persons, or to twenty-five times the entire population of that city.

But a few years shall pass away before the population of your great commercial capital will be equal to that of Boston at this date. Rail roads are even now projected and will soon be commenced from Stockton and Sacramento to the gold mines. As soon as these are completed (and they will afford a rich harvest to the stockholders), the produce of Santa Clara valley will pass over your road, not only for the supply of San Francisco, but for the whole of the eastern section of the state. What a prospect does this open for the valley, and who can estimate the accruing traffic on your road. The actual cost of transporting produce from the vicinity of San Jose to the nearest gold mines is at this moment at least $100 per ton. Construct these roads and it will be delivered at one-fourth this cost. There are, besides, many articles of a perishable nature with which they will be supplied, which are now entirely beyond their reach. The saving to the people of New York in the price of milk and vegetables by the construction of the Erie Rail Road was $980,000 per annum. What will the saving be to

the people of San Francisco, Stockton, Sacramento, and the mining districts by the construction of your road? When the rail road is built to San Jose, reasons as imperious as those which now urge you to begin your enterprise will demand the continuance of the road to the south. In a few years the rail roads constructed in other parts of the state will be united to yours by connecting links, and your road will be the artery through which these life-giving veins will pour their rich streams into San Francisco, which may, to continue the figure, be appropriately termed the heart of the state.

You have judged properly when you have assigned to your road the position of the most western link in the great chain of rail roads which, before many years, will extend from the cities of the Atlantic sea board to the commercial metropolis of the Pacific Coast.

No one can seriously entertain the idea that a public work of this magnitude will terminate at any other point than the city of San Francisco, and to reach this termination it must enter the valley of Santa Clara, and unite with your road. I have not the temerity to attempt the discussion of the national and commercial importance of this gigantic project. The execution of this task would require an amount of information I do not possess of the American people in the arts of civilization, and in extending those arts to distant countries, which can only be claimed by the wisest statesmen of the age.

I cannot close this report without expressing my obligations to Mr. A.T. Arrowsmith, Principal Assistant Engineer, for his valuable co-operation in the field, and for his assistance subsequently, in preparing the profiles and estimates.

I desire to acknowledge the services and amiable deportment of Messrs. W.A. Eliason, L.B. Healy, and A.W. Thompson, assistant engineers on the line of survey.

The map which accompanies this report has been executed with great care and precision by my associate, Mr. Sherman Day, and exhibits very clearly the topography of the country in the vicinity of the line of location.

WILLIAM J. LEWIS

Chief Engineer

San Jose, December 13, 1851

(For map, see Map Case, Document Room: Lewis, 1851)

HE 2791 .P11 A2 1851
The report of the chief engine
Stanford University Libraries
3 6105 041 781 993

461745